Chapter 12 Moles and Gases

Avogadros Law → At a constant temperature and pressure, equal volumes of gases contain equal numbers of particles.

Molar Volume of a Gas

↳ At STP, 1 mol of any gas equals 22.4 L.

Ex: (All at STP)

1.) $0.64\,mol\,Ne = \underline{14.3}\,L\,Ne$

$0.64\,mol\,Ne \times \frac{22.4\,L\,Ne}{1\,mol\,Ne} = 14.3\,L\,Ne$

2.) $15.2\,L\,Ar = \underline{0.67}\,mol\,Ar$

$15.2\,L\,Ar \times \frac{1\,mol\,Ar}{22.4\,L\,Ar} = 0.67\,mol\,Ar$

3.) $34\,L\,O_2 = \underline{48.6}\,g\,O_2$

$34\,L\,O_2 \times \frac{1\,mol\,O_2}{22.4\,L\,O_2} = 1.52\,mol\,O_2 \times \frac{32\,g\,O_2}{1\,mol\,O_2} = 48.6\,g\,O_2$

4.) $5\,g\,H_2 = \underline{56{,}000}\,mL\,H_2$

$5\,g\,H_2 \times \frac{1\,mol\,H_2}{2\,g\,H_2} = 2.5\,mol\,H_2 \times \frac{22.4\,L\,H_2}{1\,mol\,H_2} = 56\,L\,H_2$

$56\,L\,H_2 \times \frac{1000\,mL\,H_2}{1\,L\,H_2} = 56{,}000$

Ideal Gas Law

$\propto$ proportionate

Boyles Law - $V \propto \frac{1}{P}$

Charles' Law - $V \propto T$

Avogadro's Law - $V \propto n$

$V \propto \frac{nT}{P}$

add constant

$PV = nRT$

R = Ideal gas constant (Ideal gas constant)

$\frac{PV}{nT} = \frac{nRT}{nT}$

$R = \frac{PV}{nT} \quad R = \frac{(1.0\,atm)(22.4\,L)}{(mol)(273\,K)} \quad R = 0.0821\,\frac{L\,atm}{mol\,K}$

$n = ?$
$V = 20\,L$
$T = 273\,K$
$P = 1.2\,atm.$

$$n = \frac{PV}{RT}$$

$$n = \frac{(1.2\,atm)(20\,L)}{(0.0821\,\frac{L\,atm}{mol\,K})(273\,K)}$$

$$n = 1.07\,mol$$

$n = 23.2\,g$ $0.725\,mol$ $23.2\,g\,O_2 \times \frac{1\,mol\,O_2}{32\,g\,O_2}$ $PV = nRT$

$V = ?$

$T = 18°C = 291\,K$

$P = 650\,torr = 0.85\,atm$

$$V = \frac{nRT}{P}$$

$18°C + 273 = 291\,K$

$$650\,torr \times \frac{1.0\,atm}{760\,torr} = 0.855\,atm$$

$$\frac{(0.725\,mol)(0.0821\,\frac{L\,atm}{mol\,K})(291\,K)}{(0.855\,atm)} = \frac{17.32}{20.37}$$

$20.25\,L\,O_2$